Time-resolved angular distributions of plume ions from silver at low and medium laser fluence

Christensen, Bo Toftmann; Schou, Jørgen

Publication date:
2011

Document Version
Early version, also known as pre-print

Time-resolved angular distributions of plume ions from silver at low and medium laser fluence

B. Toftmann and **J. Schou**
DTU Fotonik, Risø Campus, Technical University of Denmark, DK-4000 Roskilde, Denmark (josc@fotonik.dtu.dk)

Even at moderate fluence (0.6 -2.4 J/cm^2) laser impact on metals in the UV regime results in a significant number of ions emitted from the surface. The ablated particles are largely neutrals at the lowest fluence, but the fraction of ions increases strongly with fluence.

We have irradiated silver in a vacuum chamber (~ 10^{-7} mbar) with a Nd:YAG laser at a wavelength of 355 nm and made detailed measurements of the time-resolved angular distribution. The ion flow in different directions has been measured with a hemispherical array of Langmuir probes, by which the time-of-flight spectra, as well as the total angular yield, in all directions can be recorded (1). The angular distribution peaks more strongly in forward direction with increasing fluence - as also reported in the literature – and can be well approximated by the model of Anisimov et al. (1,2).

Typically, the spectra of silver ions peak from 70 eV up to 145 eV in a direction normal to the target surface with increasing fluence. With increasing observation angle the time-of-flight spectra exhibit a peak at longer flight times, i.e. at a lower kinetic energy. At the highest fluence the ionized fraction of the ablated particles exceeds 0.5.

(1) Thestrup et al. Appl. Surf. Sci. 197-198, 175 (2002).

(2) Anisimov et al. Phys, Rev. B 48, 12076 (1993).